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ABSTRACT

Grade 7 mathematics students (n=18) were audiotaped while working in cooperative learning groups on 4 occasions over a 16 week period. After the second and third recordings, students were given edited transcripts of their discussions and were trained in how to interpret them. They used an instrument to appraise their group processes 1-2 times per week thereafter. The self-assessment had a beneficial impact on the frequency and quality of help seeking and help giving, and on student attitudes toward asking for help. The effect of the assessment procedures was attributed to three factors: (1) the feedback strengthened helpfulness norms built up in the classroom over the previous 4 months of cooperative learning implementation; (2) the feedback increased students' skill in asking for and giving help; and (3) the assessment enhanced students' self-efficacy. The paper includes the group appraisal instrument, coding scheme, and questions for comparing transcripts. Contains 65 references. (Author/MKR)

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EFFECT OF FEEDBACK ON STUDENT BEHAVIOR IN COOPERATIVE LEARNING GROUPS: A CASE STUDY OF A GRADE 7 MATH CLASS[1]

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Grade 7 math students were audio-taped while working in cooperative learning groups on four occasions over a sixteen week period. After the second and third recordings students were given edited transcripts of their discussions and were trained in how to interpret them. They used an instrument to appraise their group processes 1-2 times per week thereafter. The assessment had a beneficial impact on the frequency and quality of help seeking and help giving, and on student attitudes to asking for help. The effect of the assessment procedures was attributed to three factors: the feedback strengthened helpfulness norms built up in the classroom over the previous four months of cooperative learning implementation; the feedback increased student skill in asking for and giving help; the assessment enhanced students' self-efficacy.

Prescriptions for giving students feedback on their group work abound in the cooperative learning literature (e.g., Ellis & Whalen, 1990; Johnson & Johnson, 1984, 1987; Kagan, 1988), but the consequences for students of these strategies have not been investigated. This pilot study assessed the impact of a feedback strategy on the frequency and quality of students' attempts to help one another learn. Students were audio taped when working with peers, presented with edited transcripts of their interactions, trained in how to interpret them, and given an instrument to appraise their subsequent discussions. Although the research was conducted in a single classroom without a control group, the findings suggest that giving students feedback on their behavior has the potential to improve the quality of their interactions.

Theoretical Framework

Despite the success of cooperative learning approaches to peer-mediated instruction (Slavin, 1992), not all studies show that it is superior to well designed whole class teaching (e.g, Ross, 1988). One reason for the variability in outcomes might be the quality of interaction within the groups, particularly if low ability student participation rates are low. Dale (1993) observed

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that students who were perceived to have weak task-relevant skills were marginalized by their peers in a co-authoring activity. L. King (1993) found that when low ability students were assigned leadership positions their roles were usurped by the more able; the contributions of lower performers to group decisions were limited to minor procedural suggestions. The dominance of cooperative group work by more capable students is particularly strong when the goal is to produce a single group product (Matthews, 1992). In these circumstances, students who feel their offerings are of little value respond by withdrawing from the task (Karau & Williams, 1993). Lower ability student passivity and upper ability dominance in small groups have been reported by Good, McCaslin and Reys (in press) and by Mulryan (1992, in press).

There are several factors that might reduce the engagement levels of lower ability students in cooperative groups. Lower ability learners might be hesitant to act in a group because the frequent changes in strategies used to teach lower performers (reported in Good, Slavings, Harel & Emerson, 1987) create uncertainty, impede the development of self-regulation and encourage dependency. Past failures might create negative expectations for future success, depressing feelings of self-efficacy: Students with low self-efficacy are less likely to persist on a task (Bandura, 1993). Mulryan (in press) suggested that pressure from high ability students to complete tasks quickly (observed in Ross & Cousins, 1993a) might create a helper/helpee caste system that reduces participation by the less able. A similar argument has been made, from a different perspective, by proponents of special programming for gifted learners (e.g., Robinson, 1990) who argue that cooperative group work requires higher levels of participation from more capable students to compensate for the lower skills of lower performers.

Participation in itself is not sufficient. Lyons (1984) and Moust, Schmidt, DeVolder, Belien, & DeGrave (1987) each found that frequency of participation in group work was unrelated to learning. Battistich, Soloman and Delucchi (1994) observed that the quality of interaction was pivotal. If group interactions indicated that students were concerned for one another, high student participation was associated with positive outcomes. But if the level of peer concern was low, high participation had a negative impact.

There is consistent evidence from process-product studies that the frequency and quality of help seeking and help giving influence learning in group work.

Help Seeking. Seeking help contributes to achievement. It provides an opportunity to observe and model more expert group members (Azmitia, 1988; Kuhn, 1972). Verbalizing the request involves rehearsal of the material to be learned (Bargh & Schul, 1980). By externalizing thoughts as questions, the student brings them to conscious scrutiny and makes them more accessible (A. King, 1990). Asking for help stimulates conceptual conflict with other students that can lead to cognitive restructuring (Doise & Hanselmann, 1991; Forman, 1989), and by sharing

information processing demands with peers, the learner frees mental space that could be used to focus on challenging learning tasks (Corno & Mandinach, 1983).

Different types of help might be sought. (a) Asking for simple information contributes to learning if an answer is received (Ross & Raphael, 1990; Webb, 1984b; Webb & Kenderski, 1985; Webb, Ender & Lewis, 1986); if not the effect is negative (Webb 1982; Webb & Kenderski, 1984; Webb, 1984a). (b) Asking for evaluations, although occurring frequently, is unrelated to achievement (e.g., Ross & Cousins, 1992). (c) Asking for explanations is potentially the most powerful learning strategy but the results have been mixed. Some studies have found a positive effect (Ross & Cousins, 1993a; Webb & Kenderski, 1985); others have not (Webb, 1982, 1984a; Webb & Kenderski, 1984). When an explanation-seeker is given no response or an unelaborated factual reply, the effects are negative (Ross & Cousins, 1993a; Webb, 1982; Webb & Kenderski, 1984, 1985).

These findings from process-product studies demonstrate the effectiveness of particular tactics. But the quantitative approach might miss dimensions discernible in a qualitative pass through the data, such as the strategy for making requests (Wilkinson & Spinelli, 1983 found that effective requests are explicit, focused, repeated and directed toward an individual) or the purpose for help seeking (Nelson-LeGall, 1990 found that requests based on a mastery orientation were more likely to be productive than those which issued from dependency). Especially important is whether the help requested is necessary: students do not know when they need help (Markman, 1979), do not seek it when it is needed (Good, Slavings, Harel & Emerson, 1987; Karenbenick & Knapp, 1988) or request it when it is not required (Nelson-LeGall, 1987).

Help Giving. All forms of academic help giving contribute to the help givers' achievement, including giving (a) unelaborated information (facts and procedures) (Ross & Raphael, 1990; Webb, 1984a; Webb & Kenderski, 1985), (b) evaluations (Ross & Regan, 1993b), and especially (c) explanations (Peterson & Janicki, 1979; Peterson, Janicki & Swing, 1981; Ross & Raphael, 1990; Swing & Peterson, 1982; Webb, 1980, 1982, 1984b; Webb & Kenderski, 1984, 1985; Webb et al., 1986).

Additional dimensions emerge from qualitative explorations of student talk in context. The quality of explanations students give is critical. A high quality explanation might consist of a peer modelling the correct performance while providing a verbal commentary that describes how the performance was generated, using language and ideas familiar to the learner. A quality explanation is one that provides the specific answer required by the immediate task while providing the student with sufficient procedural knowledge to solve future problems of a similar type on his/her own. The quality of peer explanations is typically poor (Cooper, Ayers-Lopez & Marquis, 1982; Mehan & Riel, 1982; Ross & Cousins, 1993a). Explanation givers' procedures for monitoring the results of their help affect its utility. Student help givers tend to be insensitive to

the needs of help seekers and rarely assist in testing their understanding of the help given. Although some researchers observed effective student monitoring (Hooper 1992; Peterson and Swing, 1985) others who looked for such evidence failed to find it (e.g., Ross & Cousins, 1993a).

Attempts to Improve Student Interactions. Several attempts to increase the frequency and quality of student help giving have been reported. Swing and Peterson (1982) provided skits illustrating weak and effective help giving: the quality of help giving improved. These skits, along with an extensive bank of helpfulness activities, have been used by other researchers. The impact on student achievement and students' regard for their peers has been mixed (Farivar, 1991, 1993; Webb & Farivar, 1993; Webb, Qi, Yan, Bushey & Farivar, 1990).

Research Questions

The preceding considerations led to a feedback strategy consisting of recording students, giving them coded excerpts from transcripts of their conversations, and training them in the interpretation of the codes. The research was an exploratory pilot study conducted in a single classroom over a 16 week period using qualitative and quantitative methods. The following questions guided the research:

1. What effect does feedback have on student-student interactions? We anticipated that the frequency of student help seeking and help giving would increase. We also predicted that the quality of student helpfulness would improve, particularly the explanation sequences, such that they would increasingly be characterized by effective explanation seeking, explanation giving, and monitoring, as students became more familiar and compliant with classroom expectations.

2. What effect does feedback have on students' attitudes toward seeking and giving help? It was predicted that student attitudes would become more positive after feedback because uncertainty about their helpfulness performance would be reduced.

3. What effect does feedback have on teacher-student interactions when students are working in cooperative learning groups? It was predicted that the feedback would stimulate the teacher to model and reinforce the desired student behaviors.

Method

Sample

Ms. Bennett, a reputationally effective teacher participating in a year long cooperative learning in-service, was in her late 30's with six years of teaching experience, having come to teaching following a career as a museum curator. She had spent her entire career in the same Catholic school and was currently teaching grade 7. Her personal teaching efficacy scores, measured on three occasions throughout the year (Gibson & Dembo, 1984), were consistently very high. Ms. Bennett was an enthusiastic proponent of cooperative learning who implemented the techniques in virtually every math class for at least 15 minutes. Her school was in a small city with about 5% of the students bused in from the countryside. The average family income was

typical for the province in which the study was conducted ($CAN 57 300) and parental occupations were a mixture of blue and white collar jobs. There were 18 students in the class; one was gifted.

Instruments

Student interactions when working in cooperative groups in math class were audio-taped on four occasions, two before and two after the feedback procedures were implemented. There were five groups (N=20 transcripts); each was recorded for 25-30 minutes. Verbatim transcripts were made. In the first pass through the data, a single trained coder applied the quantitative scheme (adapted from Webb, 1989) displayed in Appendix A. There were three levels of requests: asking for explanations, procedures/facts or evaluations. Requests were coded as answered if the requestor received a relevant response within 10 transcript lines of the request. There were five types of responses: giving procedures/facts, explanations (consisting of rationales, demonstrations and/or references to previous examples), acknowledgments (non-evaluative and content free recognition of comments from a peer), and evaluations (of self, other students or the task). In some instances these responses were unsolicited. A random sample of transcripts was independently coded by the coder for this study and by a second experienced coder. The inter-rater reliability (Cohen's k) was .93 on 97 coding decisions.

The second pass through the data focused on explanation sequences. The four transcripts for each group were analyzed as a set. We read each transcript, occasionally re-listening to the tapes, marking explanation sequences. An interpretive note was written for each, describing the stimulus for the interaction, the nature of the explanation, and any monitoring of the recipient's understanding. At the end of each transcript the participation of each group member was summarized and heuristic questions about the future behaviour of individuals were developed (e.g., "will X recognize Y's willingness to give help or will X persist in asking Z, despite Z's disinterest?") At the end of the transcripts for sessions 2 - 4, changes from the previous session were summarized.

Student attitudes toward help giving and help seeking were measured with a self-report instrument. Students were asked to "think of a time when you were working in class and had some difficulty with the assignment" and to respond to a series of statements using a five-point scale ranging from "not likely" to "very likely" or "not true of me" to "very true of me". Twelve items measured willingness to seek help from peers (e.g., "How likely are you to ask for help from other students when. . .you don't understand how to do the assignment?") and five items measured the costs of peer help seeking (e.g., "I feel shy about asking questions of other students.") The same situations were used for help giving: ten items measured willingness to give help and five items concerned the cost of giving help. Evidence of the reliability and validity of the scale is

provided by Ross (in press) and Ross and Cousins (1993a). The attitude items were administered at the beginning and end of the project.

Ms. Bennett's understanding of her goals and strategies, her observations on individual children and her implementation of the feedback strategy, were obtained through open ended interviews during the development of the study procedures, prior to and following each recording session, and at the end of the project. Student conversations when reviewing the transcript excerpts were recorded on one occasion.

Treatment

There were two rounds of feedback. Round one (which began in week 6), started by asking students to give examples of good group work and to define its characteristics. The Self-Assessment Target shown in Figure 1 was introduced as an instrument for measuring the quality of group work. Attention focused on (a) the categories of requesting help, giving help and being on task, (b) the scales used to record group performance, and (c) the space for recording good explanations. There was a brief skit (designed by Swing & Peterson, 1982) distinguishing high level from low level help. Students met in the groups in which they were recorded and received copies of a five page excerpt of their group's conversation. The excerpts were verbatim transcripts except that student names were replaced by colors. Students were told that they should not reveal their colors to other group members. The purpose of the confidentiality was to minimize the costs of social comparison within the group. The transcripts were coded in terms of the three categories in (a). Students were asked to review the transcripts and assign their group a score on the three dimensions of the Self-Assessment Target. They then received a copy of the coder's judgment of their group's performance on the three categories in (a). The final student task was to devise an improvement plan to increase the frequency of the three categories of conversation. Most groups spent 40 minutes in this session. Students continued to use the Self-Assessment once or twice per week thereafter.

Figure 1 About Here

Round two (which began in week 12) started with a 40 minute review of transcripts. Students received two transcripts, one recorded before they received feedback and one recorded after. Names were replaced with colors and the transcripts were coded in the same way as in round one except that requests for explanations and explanations given were each boxed. Students got questions to help them compare the transcripts such as: has the number of requests for help increased, decreased or stayed the same? The full set of probes is shown in Appendix B. Students continued to use the Self-Assessment once or twice per week for the next four weeks.

Procedures

Ms. Bennett collaboratively developed the feedback procedures with the researchers. The attitude surveys were administered in week 1. Over a four month period, students were recorded

on four occasions and the feedback procedures were implemented. Recording 1 was made in week 1 of the project; recording 2 occurred in week 4. Recording 3 was made in week 10, one month after the first round of feedback began. Recording 4 occurred in week 16, one month after the second round of feedback began. The student attitude surveys were re-administered in week 16. Interviews with Ms. Bennett were conducted at the beginning and end of the project and at each recording session.

The transcripts were coded and code frequencies for each child for each recording session were calculated, adjusted by the duration of the recording session (by dividing by the number of tape units and multiplying by 100 to eliminate decimals). Changes in mean frequencies of codes between interventions were calculated using planned orthogonal contrasts (helmert). The first contrast compared the code frequencies in recording sessions 1 and 2 (before the feedback) to sessions 3 and 4 (after the feedback); the second contrast compared sessions 3 (after the first feedback) to session 4 (after the second feedback). Explanation sequences were analyzed using the qualitative procedures described above.

Results

Implementation of Cooperative Learning

The data were collected after Ms. Bennett had been implementing cooperative learning for four months. Although she used a variety of cooperative learning techniques, her basic approach was STAD - Student Teams-Achievement Divisions (Slavin, 1990). Students worked in mixed-ability, mixed-gender groups of 3-5 members which changed monthly. (Students were recorded in the same group on all four occasions.) Students were given individual and group rewards consisting of teacher praise and feedback, recognition (stickers and certificates), and bonus marks. Ms. Bennett reported that prior to the data collection her students had become more tolerant of one another. Although there were a few students with deficient social skills, she believed that most were working well together. The frequency of her use of cooperative learning remained constant all year.

The student tasks during the recording sessions reviewed operations with fractions (recording #1), multiplying by percentages (#2), sequencing operations (#3), and drawing geometric figures (#4). Students were expected to work together with each student completing his/her own answer sheet.

Implementation of Feedback Procedures

Prior to the project Ms. Bennett had given students feedback on their group work, using teacher observations, peer appraisal and self-evaluation. The categories of feedback were general--what went well and what went poorly. A major concern was discouraging "put downs". Ms. Bennett reported that she implemented the feedback procedures as intended, a claim that was supported by the audio tapes of students analyzing the transcripts. The replacement of names

with color codes fooled no one; students quickly identified each color. Although they spent some of their time searching the transcripts for humorous detail, they focused on the codings. Students responded positively to the Self-assessment Target, particularly after Ms. Bennett structured several practice activities in which students provided examples of questions that were asked in their groups, rated the questions, suggested how each might be improved, and described the characteristics of good answers. Ms. Bennett distributed the Self-assessment Target regularly, but she was not entirely satisfied with it and continued to use other checklists from time to time.

Quantitative Analysis

Table 1 displays the frequencies of the talk codes for the four recording sessions. Table 2 summarizes the results of the planned orthogonal contrasts. The first column represents the changes in the mean frequencies of the student talk codes from before (recording sessions 1 and 2) and after feedback (recording sessions 3 and 4). The second column represents changes between the first feedback (recording 3) and second feedback (recording 4). After the feedback the number of requests for facts and procedures increased, both for requests that were answered and those that were ignored. Requests for evaluations and explanations were unaffected. Four of the five categories of giving help increased after feedback. The most striking were for giving procedures/facts and, to a lesser extent, giving non-evaluative acknowledgments. The frequency of positive evaluations increased, as did giving explanations, although the means for explanations remained small. The frequency of off-task behavior also declined. There were fewer significant findings for the contrast of the first and second feedback rounds. Unanswered requests for procedures/facts declined. Giving procedures/facts and negative evaluations also declined. In summary, the feedback appeared to have an impact on students, particularly in the frequency of help giving. The impact was most keenly felt after the first feedback round. These quantitative indicators of impact are not in themselves convincing. There were only four measurements (too few for a valid time series design) and the tasks assigned to students were not the same in each session.

Tables 1 and 2 About Here

Table 3 displays the means and standard deviations for the pre- and post-test attitude measures. The table shows that students became more willing to seek help after the treatment.

Table 3 About Here

Qualitative Analysis: Student-student interactions

Although the quantitative analysis showed no changes in the frequency of high level requests, the qualitative analysis indicated that a few lower ability students became more willing to seek explanations after the feedback. For example, Cliff (ranked 15th) participated very little in the first two sessions. He failed to ask for help when he needed it and on the rare occasions that he asked for assistance he did so by merely stating, and then repeating, an answer that was

different than that of other group members. In later sessions the frequency of Cliff's requests increased. Sharon (ranked 12th) and Craig (13th) also became more willing to ask for help. In contrast Yvonne (ranked 14th) showed little progress. She copied the answers of others in session 1 ("she's writing your answer down, she's just writing it"), despite the advice of her group ("don't Yvonne; work it out"). She also blamed others for her difficulties ("I do bad on my test because Gord's just not helping me."). Both practices continued into later sessions.

The qualitative analysis suggested that students of every ability level came to realize that those who needed help should ask for it. For example, in session 4 Sandi (ranked 5th) asked Ron if he understood what he was doing, "because if you're having troubles, say it, okay?" Also in session 4, Gwen (ranked 9th) criticized Craig for not asking for help when he needed it and one of the lowest ability students, Allan (ranked 17th), surveyed the group "does anybody need help? does anybody need help here?"

There were fewer unnecessary requests for help after the feedback, although distinguishing necessary from unnecessary requests was very difficult. There were several instances of students asking for help and then denying they needed it in the early sessions, but none were observed after the feedback. For example, in session 2 Allan asked Ron for help, but when it was provided he said, "I know how to do it. . .I was just testing your head."

Explanation seekers were more persistent in sessions 3 and 4 than they were in sessions 1 and 2. For example, when Sandi had difficulty drawing a geometric figure she made a series of requests that became increasingly precise in describing her need: "Dominique, you know how to do this?", then "you know how to do this thing?", followed by "do you change this to bigger?", and finally the request that evoked the response, "Do you make your compass bigger when you do the two little arches?" Other students increased the quality of their requests after feedback by being more precise. For example, Edwin used more technical terms, such as exponent and "bedmas" (a mnemonic for sequencing arithmetic operations), in his requests after feedback. The most important change in help seekers was the recognition that high level help was more valuable. In Sharon's words: "I have to understand it. Not just say the answer."

There were some changes in the selection of the person to whom the request was addressed. For example, Louise preferred to ask Ms. Bennett for help whenever the teacher visited the group in sessions 1 and 2. In the later sessions Louise asked her peers instead, even though she expressed impatience when the group was not ready to address her concerns.

In summary, after feedback lower ability students became more willing to seek high level help, the proportion of unnecessary requests declined, requests became more persistent and precise, and there were changes in the person to whom requests were directed.

There were substantial changes in explanation giving, particularly in willingness to give help, after the feedback. For example, in sessions 1 and 2 Ron (ranked 1st) was relatively

indifferent to the needs of his group. The only time he provided high level help occurred when Ms. Bennett visited the group and specifically asked him to explain his solution to one of the items. In contrast, in sessions 3 and 4 he was eager to give help, responding to every request that was made of him and offering additional assistance whenever he noticed that a group member had made an error. He was conscious that he had changed, saying to his group, "do you notice I'm being a lot nicer?"

Louise and Cliff gave no help in sessions 1 and 2, even when asked. After the feedback there was substantial change. In session 3 Louise gave help in combination with Cliff and she repeated one of Heather's explanations. In session 4 she provided a demonstration of a geometric procedure that no one else knew. Cliff also became more willing to give help in the last two sessions, although there were still occasions when he avoided requests, possibly because he was less skilled in math than two other group members. Craig (ranked 13th) became more willing to help after the feedback ("give it to me here; I'll help you"), although his group was reluctant to accept help from someone with such weak skills.

Ray (ranked 11th) changed but it took him longer and the change was small. Prior to the feedback he gave no help. Ray was concerned about answer copying ("did you copy mine?. . .I don't care if you did copy me; you always do"). For him copying was a form of cheating ("You just put that [answer] down now. . .you always cheat.") and he equated help giving with answer copying. He interrupted Halyna's detailed explanation to Sonia with "don't do it for her. Halyna, don't tell her." After the feedback he began to support Halyna's attempt to show Sonia how to do one of the items but went off task, ignoring Halyna's request to participate, and began to mock her attempts to explain math to Sonia ("you could be a teacher when you grow up"). Halyna persisted in her explanation and continued to try to enlist Ray ("let's do it together, Ray") to no avail. Yet in session 4, Ray did provide help after Halyna let him know he might be asked ("will you help us if we get stuck?") and then posed a specific request ("Ray, do you know how to do 2b? Well can you please tell me. . .because I don't understand.").

After the feedback, students became more sensitive to the needs of lower ability students and recognized an obligation to attend to their needs. For example, in an early session, when Sharon fell behind the others, they would not wait and excluded her from the discussion of answers.

Sharon: Hey, what about me?

Curtis: You're not in it. . .

Sharon: Hey, you guys, what about me? . . .How come you guys won't let me do none?

Gwen: Because you're not even here yet.

Sharon: I'm on number 15.

Gwen: Yeah, I know but we're on number 16.

In session 3 Sharon was behind again but the reaction of the group was very different. They continued to treat her rather roughly but they now acknowledged their obligation to help her.

Curtis: We have to wait for her. We have to wait for her.

Gwen: Come on, Sharon. You know we are waiting. . .

Sharon: You guys were going ahead and you weren't supposed to.

Gwen: I know; we won't. We won't do the answers.

Curtis: We won't look at the answers. We'll wait for you.

Explanation givers began to adjust their messages to the level of help seekers. For example, after the feedback, Cliff, who was usually very precise in his use of technical terms, adopted Edwin's expression "timesing" when explaining multiplication to him. Julia admonished Gord for going "too fast" in his explanation to Yvonne; when Yvonne agreed that the pace was too quick for her, Julia became the explainer.

After the feedback explanation givers were aware that explanation giving, not answer exchanging, was the goal. For example, when Halyna worked out the answer before other group members, she began to give it and then caught herself: "The answer is, hold on, I'm not going to say the answer until we're done." Similarly Heather, "you can't just give them the answer, it doesn't help much. . .she has to figure it out."

In summary, after the feedback students became more willing to give explanations, they felt an obligation toward students with learning difficulties, they were more likely to adjust their explanations to the understanding of the help seeker, and they recognized that high level help was preferable to giving out answers.

The frequency of student monitoring of the effects of explanations changed after the feedback. There were three kinds of monitoring. The first was monitoring as a solution was being developed. It involved recognizing a need for help by detecting errors in the work of other students. Typically this was a task undertaken by the able for the less able. For example, Ron appraised Allan's work:

Ron: You did this [pointing] wrong. . .you did this [pointing] right. . . .You see, you have to do times, multiplication, first. So this [pointing] would be 33 and then there'd be. . . .

Allan: Oh, yeah.

Diagnostic monitoring was visible in the interactions before the feedback, but it became more common after.

The second form of monitoring occurred within explanations: A complex task was decomposed into a series of small steps and explanation givers assessed help seekers' understanding of each element by having them perform each step. If the answers were incorrect, the explanation was repeated or elaborated. Within-explanation monitoring increased after the feedback because the number of explanations, particularly lengthy ones, increased.

The third form of monitoring occurred after an explanation had been given. The weaker version consisted of asking help seekers if they understood the explanation or by giving the help seeker a quick quiz. These were slightly more frequent after the feedback because more explanations were attempted. The more powerful version consisted of assigning a practice task that required application of the target skills. This was rare. The few instances that were observed occurred only after the feedback. They were not very effective. For example, Halyna followed an elaborate step-by-step account of one question by asking Sonia to do the next one (of the same type) out loud. This strategy was less effective than it might have been because Halyna failed to shift the responsibility to Sonia. Halyna continued to break the question into its components, giving Sonia feedback as she completed each part, rather than asking Sonia to do the sequencing of the elements which was the main objective of the lesson.

In summary, monitoring of students before and during explanations increased after the feedback. There was also some instances of post-explanation monitoring occurring only after the feedback.

Qualitative Analysis: Teacher-Student Interactions

Ms. Bennett's interactions before and after the feedback were consistent. She intervened in group deliberations infrequently, but when she did her contributions reinforced the content of the feedback. When Ms. Bennett was asked for help, she first determined whether the group had the resources to solve it on their own, and if a group member had the skills she encouraged that student to attempt a solution rather than provide hers. For example, when Gord asked, "do you think you divide on question 11?", Ms. Bennett replied, "what does Julia or Yvonne think about that?" When Julia said divide, Ms. Bennett suggested "go with that and see what you end up with." After the feedback she continued the pattern. For example, when Ron asked "do we have to do 2 (b), because...we never did that", she proposed, "see if you can figure it out though. . .try it and see what happens; you know what the end product has to look like, right?" Ms. Bennett's behavior gave the groups feedback on the appropriateness of their requests for help to the teacher. If her help was unnecessary there was no need for the teacher to provide it, and she did not.

Ms. Bennett gave elaborated help if the group was genuinely stuck. Before the feedback Louise told the teacher, "no one knows this question. . .we forget how to do it." When Heather said she could, Ms. Bennett had her begin. Heather's uncertainty unfolded with her solution and suggestions were offered by group members. Ms. Bennett supported Heather's attempts with responses which constituted a model of how to explain in which the help seeker provided as much of the solution as she could. The explainer gave feedback, shouldered some of the burden of the task (by filling in missing steps and recording the help seeker's thinking), developed a problem solving heuristic from the example, and assigned a practice task that required the help seeker to recapitulate the steps.

Heather: First you have to find the common denominator.

Ms. Bennett: Okay.

Heather: And then you have to change it to an improper fraction, no, regroup first.

Ms. Bennett: Regroup. You don't change to an improper fraction for subtraction or addition. . . .So there's your common denominator which is 15 - 8 over 12. Is that what you got?. . .I don't understand what you have done. Here, let me write it out for you. . . . Okay, so common denominator is. . .right. . .now, Heather, where do you regroup from?...okay, what do we have to do to the 6? . . .good girl, that's right.

Louise: What do you do with the 3 though?

Ms. Bennett: Well, what do you think you should do with the 3? . . .That's right. . .Yeah, you're okay. I think what you have to do with questions like that, is that you have to take it step by step. . .you can't jump. . .otherwise you're going to get confused and when you go back to see what you did, you're not going to know what you've done because you skipped a step. . . .Now you're going to have to share your knowledge with these two because I don't know if they know.

After the feedback the pattern of the teacher giving necessary help continued. When Sonia asked "which one [operation] do you do first?", Ms. Bennett reminded her of the sequencing rule and gave Sonia enough support for her to do the question by herself by giving her feedback, additional instruction and practice.

Ms. Bennett: What do you do according to 'bedmas'?

Sonia: brackets

Ms. Bennett: Umhum. Then what? . . .What's that (e) stand for? . . .Umhum. . .Yeah absolutely. You do the exponent and then you move along 'bedmas'. . . .What does that mean, Sonia? 1 to the exponent means what? . . .times what? . . .that's right; don't tell me it's 1 X 8. . .it's not right. . .are you sure? . . .okay. . .do you understand this, Sonia? . . .listen to me. What's 4 to the exponent 3? . . .that's right. . .no, no, no, back up. . .are you sure? what is it 6 or 5?. . .okay. How do you use the exponent? Why would you leave the exponent in your answer?

In summary, Ms. Bennett's interactions with the group were consistent. Although she did not intervene extensively, her contributions reinforced the feedback. Her response to requests was first to determine if the request for help was necessary. If resources to solve the problem existed in the group, she mobilized them and told the group they did not need her help. If her help was required, she provided a model of how to explain.

Discussion

Student behavior changed when the feedback procedures were implemented. The quantitative data showed increases in the frequency of requests for facts and procedures and for

all levels of help giving. The qualitative data indicated that the quality, if not the overall frequency, of requests for explanation increased. Some lower ability students became more willing to seek help, the proportion of unnecessary requests declined, and requests became more persistent, precise and appropriately directed. Students were more willing to give explanations after the feedback; they felt an obligation toward students with learning difficulties; they were more likely to adjust their explanations to the understanding of the help seeker; and they recognized that high level help was preferable to giving out answers. Finally, peer monitoring of students increased after the feedback. There was more before, during and after explanation monitoring.

The impact of feedback on student helpfulness might be attributed to three factors. The first, and most important, is that the feedback procedures strengthened helpfulness norms already established over the preceding months. Help seeking is extinguished when students fear peer ridicule (Newman & Goldin, 1990) and children are more likely to give help when adults expect it (Ladd, Lange, and Stremmel, 1983). By explicitly repudiating "put downs", by describing the categories of behavior that were expected in group work, and by reinforcing these behaviors in her interactions with students, Ms. Bennett provided a sharper definition of what it means to cooperate. The impact of her appeal was enhanced by her strategy of collaborating with students in the design of the assessment, giving students a voice in the identification of the categories of behaviour to be observed, sharing responsibility for administration of the procedures, and inviting them to participate in the interpretation of results. The assessment methods influenced students by focusing their attention on the specific "learning to learn" objectives of working in cooperative groups.

A second explanation is that the feedback procedures influenced students' behavior by increasing their skill in asking for and giving help. Ms. Bennett not only provided a model of helpfulness in her whole class presentations and illustrated it in her interactions with students, she also enabled students to find out how well they were meeting her expectations. The assessment increased student adoption of the desired behaviors by giving them a tool to appraise their helpfulness, and that of their peers, in a climate supportive of constructive social comparison. Uncertainty about performance was reduced, thereby reducing student stress and distraction from the intended goals. Ms. Bennett's decision to make the observation procedures open, frequent, and expected, increased the likelihood that students would focus on task-relevant thinking rather than on self-preoccupations that impede performance (Sarason, 1987).

Third, recognition of success in achieving the helpfulness goals of the classroom may have enhanced students' feelings of self-efficacy. Bandura (1986) found that reflection on past successes and failures leads individuals to predict how well they would perform similar tasks in the future. These anticipations influence willingness to engage in the tasks, the amount of effort

expended, and persistence in the face of adversity. Self-efficacy is also influenced by the social context. Bandura's theory suggests that vicarious experience, such as listening to peers describe their ability to be helpful, and persuasive messages from contemporaries that each group member is able to be helpful would contribute to enhanced self-efficacy.

A competing explanation for the observed changes in student helpfulness is history, a threat to the internal validity of time series research designs. It could be argued that the changes recorded after the feedback procedures began were merely a continuation of processes already underway, as the motivational impact of the reward structure increased the ability of groups to manage their members (Slavin, 1992). Increasing familiarity with other students might also have developed over time. Since familiars are more likely to be the objects of help seeking (DePaulo, 1979; Nelson-LeGall & Gumerman, 1984) and help giving (Amato & Saunders, 1985), students are more likely to help if a reciprocal pattern of helping has been established (Berkowitz & Friedman, 1967) as it would over the relatively long duration of the project (16 weeks, preceded by four months prior implementation of cooperative learning). A further threat to the internal validity of the findings was the between-session variability in the demands of the task. Each session focused on a different math topic and although the relationships between task demands and student talk have not been systematically explored, it would be inappropriate to assume there were no effects. A more controlled study using an appropriate comparison group would be required to determine the extent to which the impact of the feedback procedures was distorted by history and between-session task differences.

Implications for Schools

Limiting Conditions

The findings about the impact of feedback on student behavior might not generalize to all ages. The tasks in the feedback procedure might be too challenging for younger students; they could be overwhelmed by the transcripts or be confused by the format of the self-assessment target.

There might be an interaction of group composition with task difficulty that might limit the generalizability of results. Ms. Bennett distributed student resources relatively equally across groups so that each had a mixture of high, medium and low ability students and she assigned tasks consisting of previously learned algorithms or routine geometric operations (e.g., bisecting an angle). All groups had at least one member who was able to perform the tasks, even if the skills did not immediately surface. The absence of either of these conditions (group composition or task difficulty) might affect students' ability to use the knowledge provided by the feedback. Students who need help could have so little grasp of task demands they could be unable to formulate precise requests or might not know if anyone in the group had the answers. Help givers might be

similarly constrained. Not being able to do the task could inhibit their attempts to help others and reduce their ability to recognize when others needed assistance or the type of help required.

The feedback procedures might not be effective if the teacher failed to reinforce the desired behaviors when interacting with the groups. In Ms. Bennett's model the explanation giver shouldered a portion of the burden by supplying steps that were missing, gave immediate feedback on progress, identified key concepts to be learned, and assigned practice tasks to consolidate the learning. This model was consistent with the conception of giving help contained in the project's feedback procedures. In addition, Ms. Bennett rarely intervened, doing so only when a group asked for help, and only then when she had determined they lacked the resources to solve the problem on their own.

Adaptations of the Feedback Procedures

The assessment procedures used in this study consisted of activities to train students in the collection and interpretation of data produced by an instrument measuring helpfulness. These procedures could be adapted to increase their classroom utility. The production of transcripts may be inessential; listening to recordings of group deliberations or having group members take turns coding the group during its discussions may be sufficient. Or the salience of the desired behaviors could be increased by giving students individual and group rewards for group processes as well as for achievement. We anticipate that the impact of the assessment on students would be sustained through these adaptations, provided that the attributes measured correspond to those associated with learning in past research and that students continue to play a role in the collection and interpretation of the data.

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Table 1

Means and Standard Deviations for Each Talk Code (Adjusted by Session Length), by Recording Session

	T1	T2	T3	T4
Help Seeking (Requests)				
procedures/facts: answered	2.64 (1.68)	4.13 (3.14)	5.05 (2.92)	4.22 (2.57)
procedures/facts: ignored	1.08 (0.69)	1.57 (1.38)	2.82 (0.98)	1.74 (1.33)
evaluations: answered	0.67 (0.52)	1.36 (1.47)	0.65 (0.42)	0.86 (0.81)
evaluations: ignored	0.55 (0.37)	0.59 (0.49)	0.63 (0.52)	0.49 (0.36)
explanations: answered	0.07 (0.10)	0.13 (0.20)	0.21 (0.29)	0.13 (0.27)
explanations: ignored	0.16 (0.21)	0.35 (0.26)	0.21 (0.27)	0.34 (0.42)
Help Giving				
procedures/facts	7.21 (2.95)	12.91 (6.74)	19.37 (7.36)	8.99 (3.88)
explanations	0.01 (0.04)	0.07 (0.18)	0.52 (0.85)	0.79 (0.91)
acknowledgments	1.90 (1.05)	2.39 (1.44)	4.44 (2.32)	3.12 (2.46)
positive evaluations	2.29 (1.28)	4.51 (2.75)	4.78 (2.40)	5.31 (2.01)
negative evaluations	1.83 (1.12)	4.14 (2.06)	4.09 (1.65)	3.07 (1.55)
Other Talk				
off-task	3.95 (2.47)	4.87 (2.94)	2.60 (2.38)	1.43 (1.23)
lost	0.91 (0.68)	0.94 (0.72)	2.01 (0.96)	1.25 (1.18)

Table 2

Changes in Frequency of Help Seeking and Help Codes After Feedback

	Helmert Contrasts	
	T1 & T2 vs T3 & T4	T3 vs T4
Help Seeking (Requests)		
procedures/facts: answered	t = -2.38, <.032*	t = 0.84, <.416
procedures/facts: ignored	t = -3.70, <.002**	t = 2.63, <.020*
evaluations: answered	t = 0.67, <.511	t = 0.94, <.364
evaluations: ignored	t = -0.92, <.928	t = 1.04, <.315
explanations: answered	t = -1.75, <.102	t = 0.75, <.466
explanations: ignored	t = -0.95, <.357	t = 0.70, <.495
Help Giving		
procedures/facts	t = -3.61, <.003**	t = 6.94, <.001***
explanations	t = -3.88, <.002**	t = -0.61, <.553
acknowledgments	t = -4.20, <.001***	t = 1.77, <.098
positive evaluations	t = -4.50, <.001***	t = 0.95, <.357
negative evaluations	t = -2.03, <.062	t = 2.93, <.011*
Other Talk		
off-task	t = 3.87, <.002**	t = 1.79, <.095
lost	t = -4.33, <.001***	t = 1.98, <.068

*p<.05. **p<.01. ***p<.001.

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Table 3

Pre- and Post-Test Student Attitudes Toward Seeking and Giving Help, Means and Standard Deviations, by Teacher

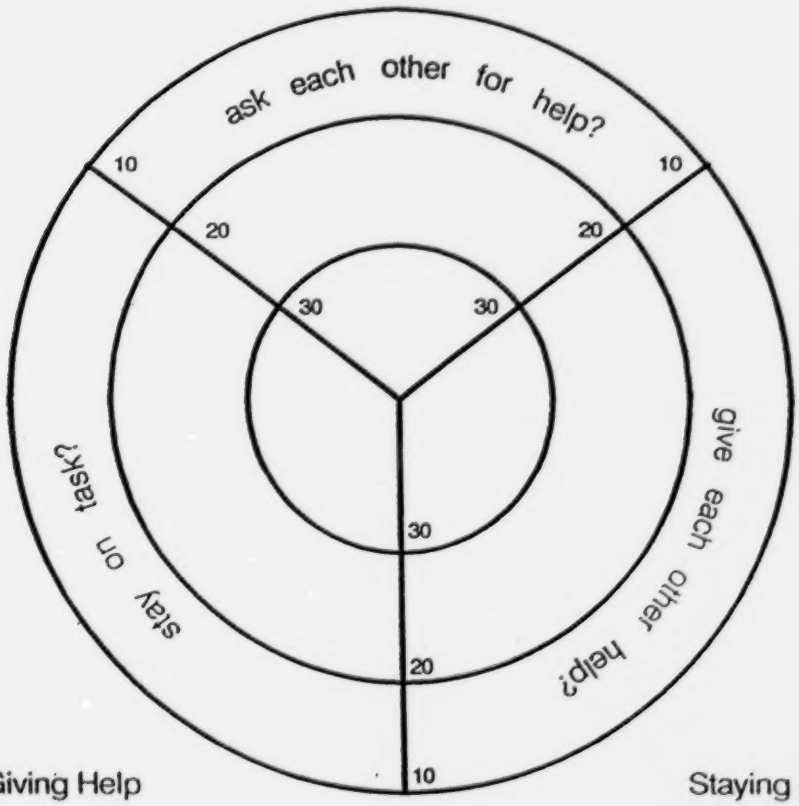
	Pre (N = 15)	Post (N = 15)
Help Seeking		
willingness	4.20 (0.63)	4.57 (0.40)*
perceived cost	2.42 (0.72)	2.02 (1.02)
Help Giving		
willingness	3.93 (0.90)	4.22 (0.67)
perceived cost	2.28 (0.76)	2.02 (1.00)

*$p<.05$

SELF-ASSESSMENT TARGET

GROUP NAME _____ DATE _____

How many times did members of your group:



Asking/Giving Help

never	0 points
once	10 points
twice	20 points
more than twice	30 points

Staying on Task

mostly off task	0 points
somewhat on task	10 points
mostly on task	20 points
always on task	30 points

Examples of Good Explanations

1. _____
2. _____

Figure 1: Group appraisal instrument.

Appendix A: Coding Scheme

R - requests

RP +/- .requests procedure (such as a review of the exercise directions) or equipment required for the task or a particular piece of information (e.g., "what's the temperature in Krakow?") required for the task: this is a request for a short response; code as RP+ if a response is received to the request and as RP- if a response is not received

REV +/- .requests evaluation (e.g., "is this right?"); code as REV + if REV+ if a response is received to the request and as REV- if a response is not received

REX +/- .requests explanation (a detailed description or explanation, not just the answer); code as REX+ if a response is received to the request and as REV- if a response is not received

G - responses to requests and contributions to the discussion

GP .gives procedure or needed equipment or fact required by the task)

GEX .gives explanation by providing a rationale, demonstrating, referring to an earlier example or teaching

GN .gives acknowledgment which is non-evaluative and content free

GEV +/- .gives evaluation of self, other students or task; code as GEV+ if positive appraisal is given and as GEV- if negative

Other Codes

O .off task (not related to the knowledge and skill of the student assignment

L .lost (uninterpretable whispers, semi-audible mumbles and incomplete on-task thoughts)

Appendix B: Questions for Comparing Transcripts

Requests

1. Has the number of requests for help increased, decreased or stayed the same?
2. Were those who needed help more likely to ask for it in the AFTER tapes?
3. Were there more requests for explanation in the AFTER tapes?
4. Examine each of the requests for explanation in the BEFORE and AFTER tapes.

    .Do these requests express what the person who needed help wanted to know?

    .Were the questions specific?

    .If the request for explanation was not answered, did the person who needed help ask again?

Giving Help

1. Did help giving increase, decrease or stay the same?
2. Were those who needed help more likely to receive it in the AFTER tapes?
3. Were there more explanations in the AFTER tapes?
4. Examine each of the explanations in the BEFORE and AFTER tapes. .Do these explanations express what the person who needed help wanted to know?

    .What does an explanation have to be like to be a good explanation?